



# WORLD HYDROGEN ENERGY SUMMIT 2021

November 16th, 2021

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Busworld Foundation

BUSWORLD foundation

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# INFO@BUSWORLD.ORG

- **Inspire passenger transport systems on a glocal scale.**
- The Busworld Foundation envisions to be THE platform where all stakeholders of the bus and coach industry and policymakers **MEET, DISCUSS, LEARN AND GROW.**
- By **BRIDGING THE GAP** between public and private sector we will shape the future of mobility by developing and defining bus & coach as a sustainable part of the solution.



BUSWORLD FOUNDATION : The Global Bus Alliance

BUSWORLD  
foundation

*the global bus alliance*

**BUSWORLD INDIA 2022 : BENGALURU, AUGUST 25th – 27th**

**marketplace:**

we connect manufacturers, suppliers,  
operators & policymakers

**knowledge exchange:**

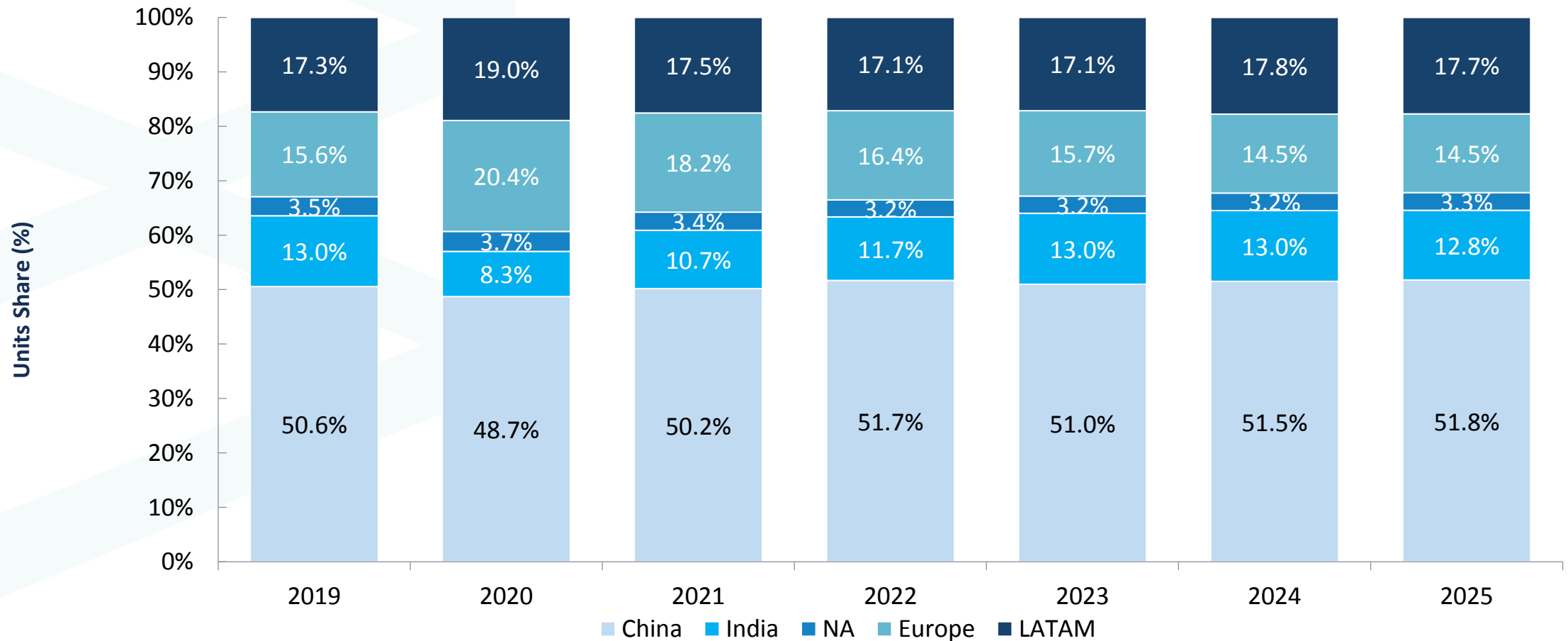
we connect knowledge givers and  
knowledge seekers

and we do this in a **pleasant  
environment**



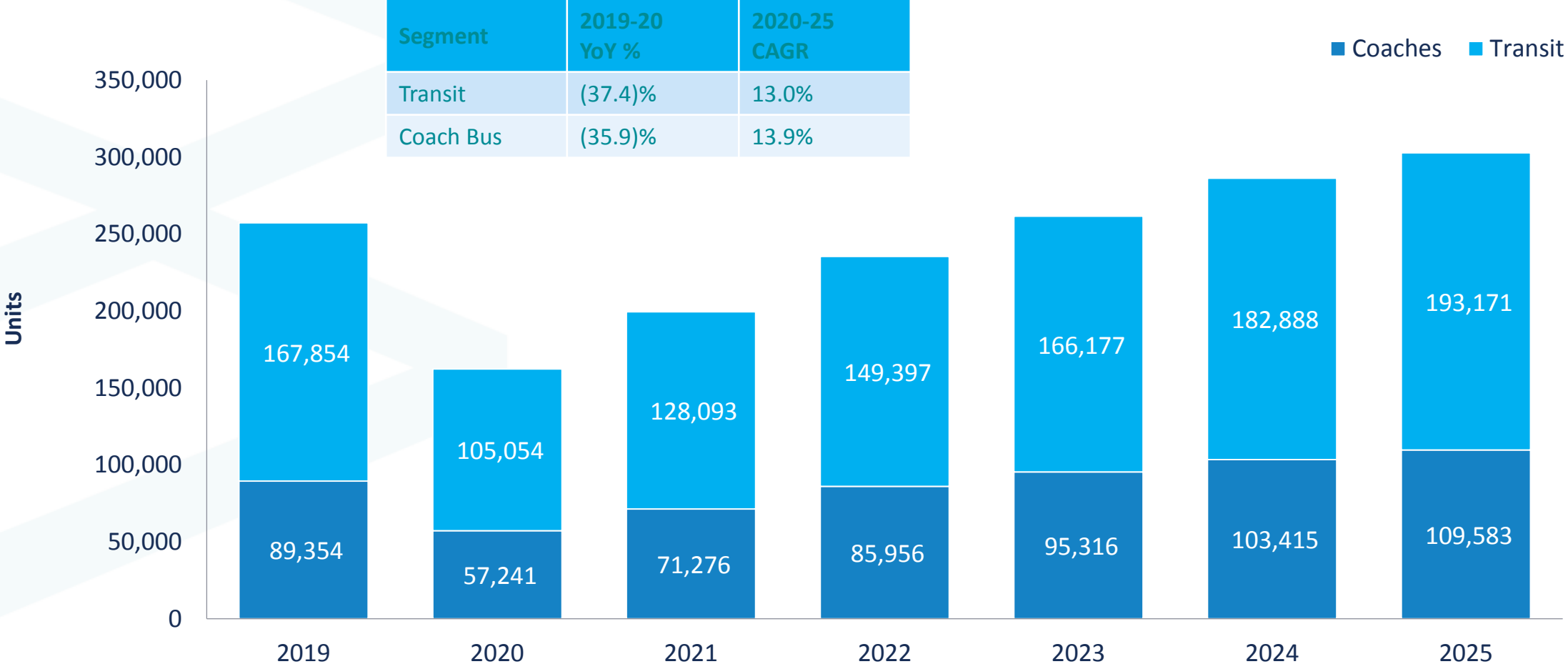
# Global Bus Market—by Region

China, Europe, and Latin America will constitute more than 75% of the market throughout the forecast period (2021–25)



# Global Bus Market — Transit vs Coach

Growing urban population supported by policy measures to reduce emissions and improve efficiency of public transportation is the major driving FORCE behind the growth of the market.


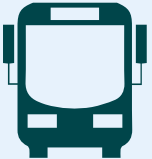


Note: All figures are rounded. The base year is 2020

Source: Frost & Sullivan

# Key Transit and Coach Bus Use Cases

## Bus Market: Use Case for Transit and Coach Bus

Application	Daily Operating miles	Operating Environment / Driving Characteristics	Premium over Diesel	Charging and Hydrogen Infrastructure	Use Case to Electrify	Comments
<b>Transit Bus</b> 	150–250	Urban Short hops, lot of transient state driving	\$200-500 k	Charging infrastructure and fuel-cell station largely located within depot and en-route through Opp-charge.	BEV: Strong FCEV: Minimal	<ul style="list-style-type: none"> <li>• Intra city bus travelling within city limits in fixed routes</li> <li>• Moderate payload, moderate daily mileage and driving mostly in transient state in urban environment makes for a strong use case.</li> </ul>
<b>Coach</b> 	200–600	Semi-Urban, Inter-city Mostly cruise mode with little transit state driving	\$300-550 k	Would require charging facilities outside city limits and highways. Fuel-cell stations at fleet compounds at end of trips.	BEV: Moderate FCEV: Moderate	<ul style="list-style-type: none"> <li>• Buses used for inter-city travel mainly on highways between distant cities.</li> <li>• Moderate payload, high daily mileage and driving mostly in steady-state makes for a weak use case.</li> </ul>

# Transport emissions

## Global CO<sub>2</sub> emissions from transport

This is based on global transport emissions in 2018, which totalled 8 billion tonnes CO<sub>2</sub>. Transport accounts for 24% of CO<sub>2</sub> emissions from energy.

Our World  
in Data

74.5% of transport emissions  
come from road vehicles



OurWorldinData.org - Research and data to make progress against the world's largest problems.

Data Source: Our World in Data based on International Energy Agency (IEA) and the International Council on Clean Transportation (ICCT).

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- 23% of global GHG-emissions comes from Transport, 17% from Road transport
- Transport emits 8 billion metric tons of CO<sub>2</sub> emissions
- 45% coming from road passenger transport
- >85% of motorised road passenger transport emissions come from individual transport modes

**BUS = 6,75% of global Transport-emissions**  
**= 1,5% of global GHG-emissions**

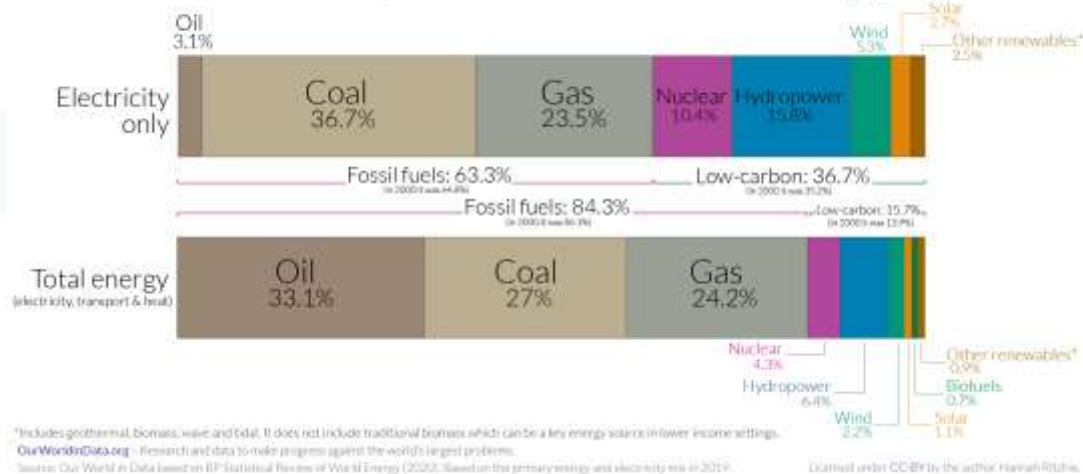
### ANSWERS

- Low & Zero emission technologies : BEV, PHEV, FHEV, ...
- The collectivisation of road passenger transport. How many car miles would we need to replace by bus-miles to equal the effect of the electrification of the busfleet ?

# Electrification of buses

## Availability of green electricity

More than one-third of global electricity comes from low-carbon sources; but a lot less of total energy does 



## TCO (FCH)electric vs diesel bus > 1

=> First deployment of electric buses only in public or big private operators in urban bus services & with strong external financial support

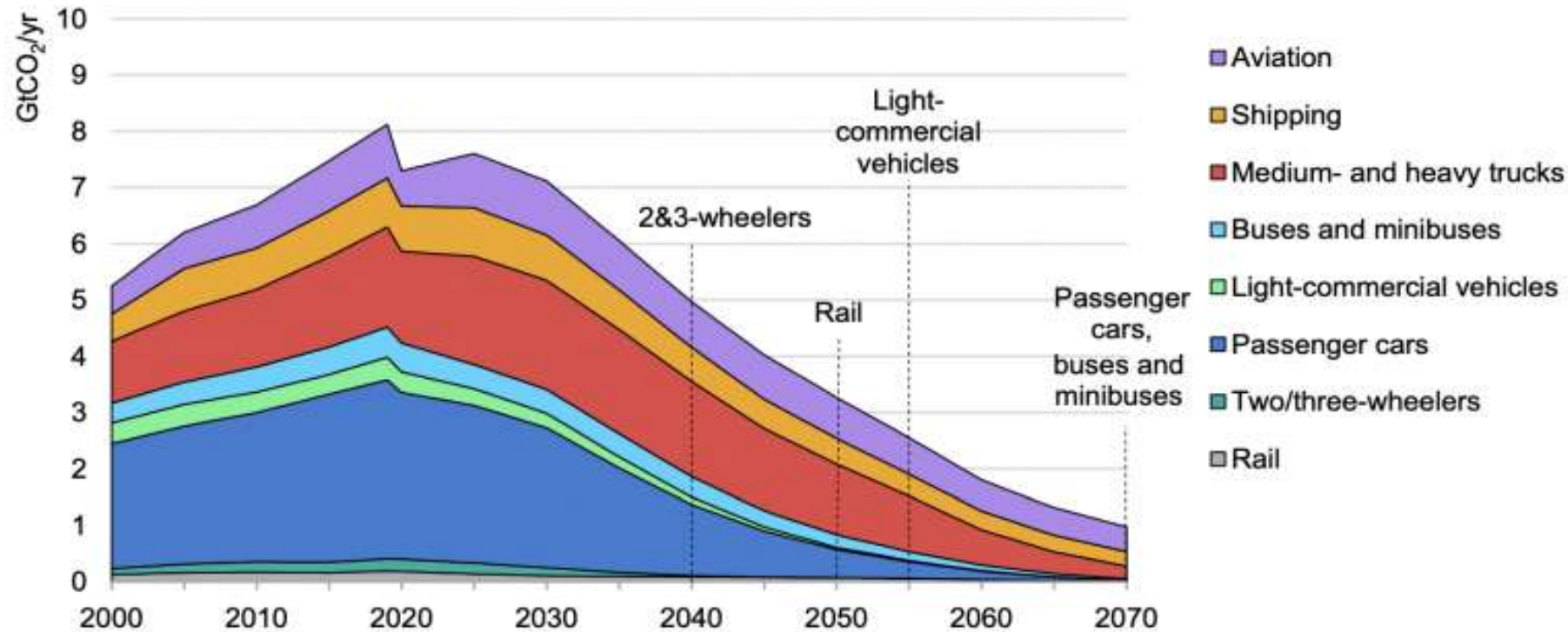
- Capex : > 2 or > 3,5 (incl depot adaptations.)
- Opex : ??? <> lifetime of the battery  
battery waste management  
staff training

.....

=>further consolidation of the industry



Figure 3.16 Global CO<sub>2</sub> emissions in transport by mode in the Sustainable Development Scenario, 2000-70

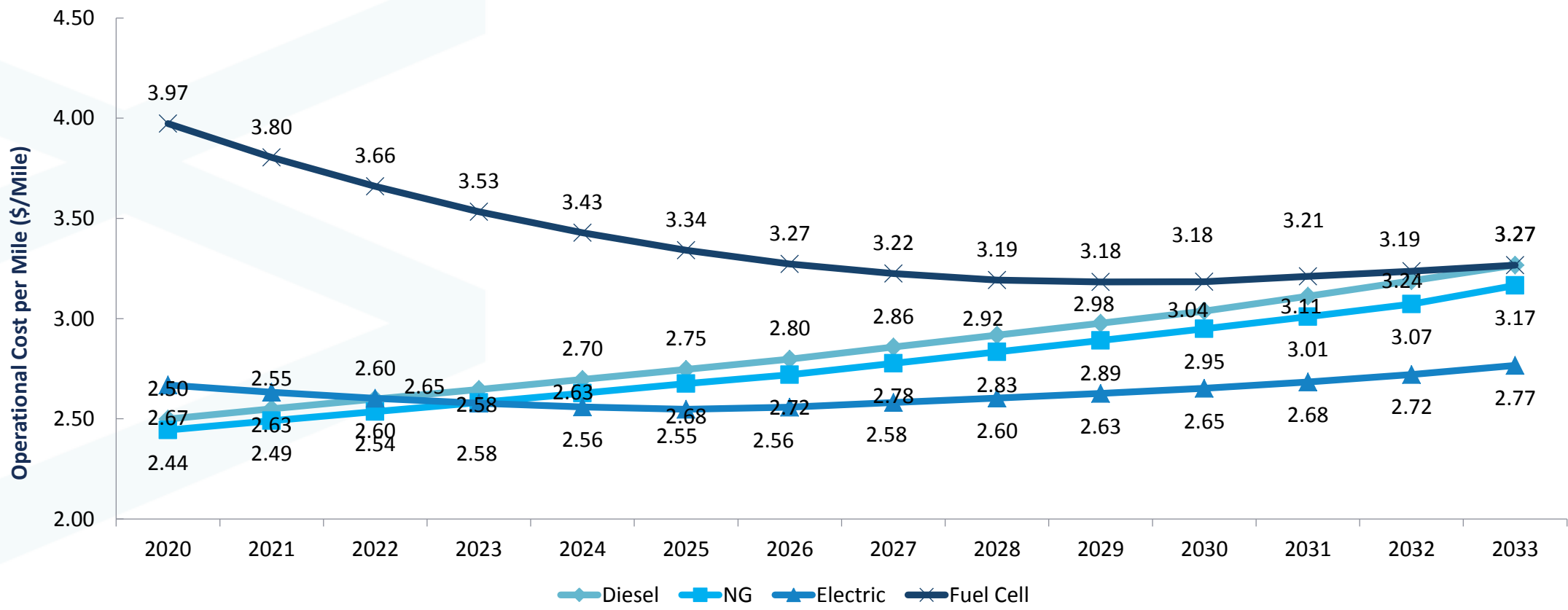


Global transport emissions increased by less than 0.5% in 2019 (compared with 1.9% annually since 2000) owing to efficiency improvements, electrification and greater use of biofuels.

# Total Cost of Ownership – Urban Bus

A lower battery price for the electric and higher fuel price for diesel buses work in favor of electric buses, making them the best alternative fuel in terms of operational cost/mile.

Bus Market: Total Ownership Cost Forecast per Mile, NA, 2020–2033



# Bus operators are energy users, not producers

- Matching the characteristics /needs of the busline & depot & energy management
- Electrification of the urban bus fleet , focus is on PHEV & BEV
- Capex (EU) : 55. 500.000 INR = 5.5 crore INR (EU prices) => evolving towards 5.12 crore by 2024 => importance of mass production
- Importance of well to wheel reasoning : Availability of green H
- Roll out of H-supply along highways, etc.
- H : Price evolution : production costs have decreased by 50% since 2010, now at about € 8-9/kg . €4/kg is required for a feasible TCO. => **need for scaling up = lowering price** => effects of steel & fertilizer production, the potential big H users
- Safety matters
- Policy & support not only for technical development but also for implementation in ROI-based operations
- Comparable fueling operations provides flexibility in operations and lower need for driver training
- Range is comparable to diesel

# Q & A

## Happy to stay in touch :

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